Backgrounds from beam losses in 20mrad extraction line and "SiD" concept detector

O. Dadoun

CNRS-IN2P3-LAL, Orsay, France

Abstract

In the International Linear Collider (ILC) the beams will be focused to extremely small spot sizes in order to achieve the desired luminosity. This leads to a large angular divergence and energy spread for the disrupted beams, which must be extracted from the Interaction Point (IP) to the dump with minimal losses. In spite of the all the attention to the design of the extraction line, we will not be able to avoid some disrupted beam particles losses. These will generate secondary particles such as photons, electron and neutron, a fraction of which can be back-scattered to the IP and generate backgrounds in the detector.

The talk presented here is a preliminary study of such back-scattered particles. To enhance the statistics, the disrupted beam for the ILC High Luminosity beam parameters at 1 TeV in the centre-of-mass is used, with a vertical offset at the IP chosen to maximising the beamstrahlung emission. The 50 first meters of the 20mrad ILC extraction line and a simple mock-up of some of the key geometries of the "SiD" detector concept were implemented within the GEANT4-based BDSIM simulation toolkit. A procedure for efficient dispatching of multiple jobs on the GRID was developed within the ILC virtual organisation, improving the turnover for large statistics runs. The first results obtained indicate that the beam-induced backscattered electrons channelled towards the vertex detector by the magnetic field have such low energies that they are essentially stopped by beam pipe. Photons in the x-ray energy range are on the other hand abundant, but their angular distribution is such that they are not expected to be dominant contribution to the vertex detector background. The rate in the TPC acceptance is on the other hand sizeable and will need to be studied further.

Acknowledgements

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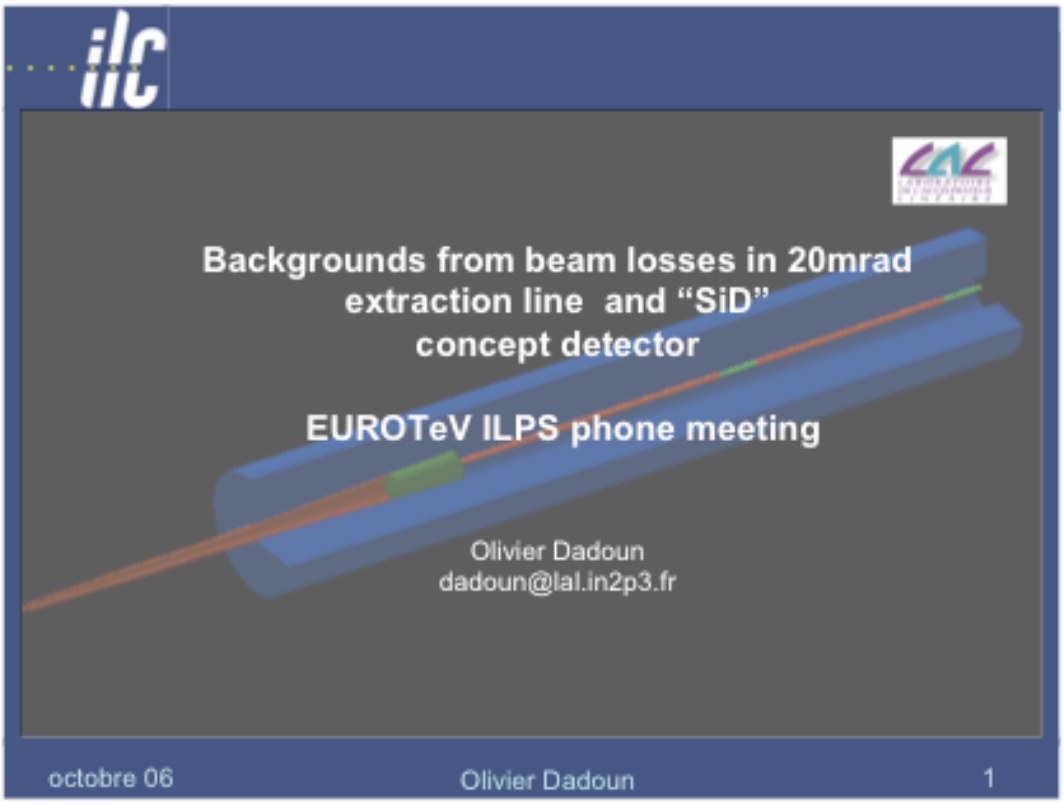
Backgrounds from beam losses in 20mrad extraction line and "SiD" concept detector
EUROTeV ILPS phone meeting
Olivier Dadoun
dadoun@lal.in2p3.fr
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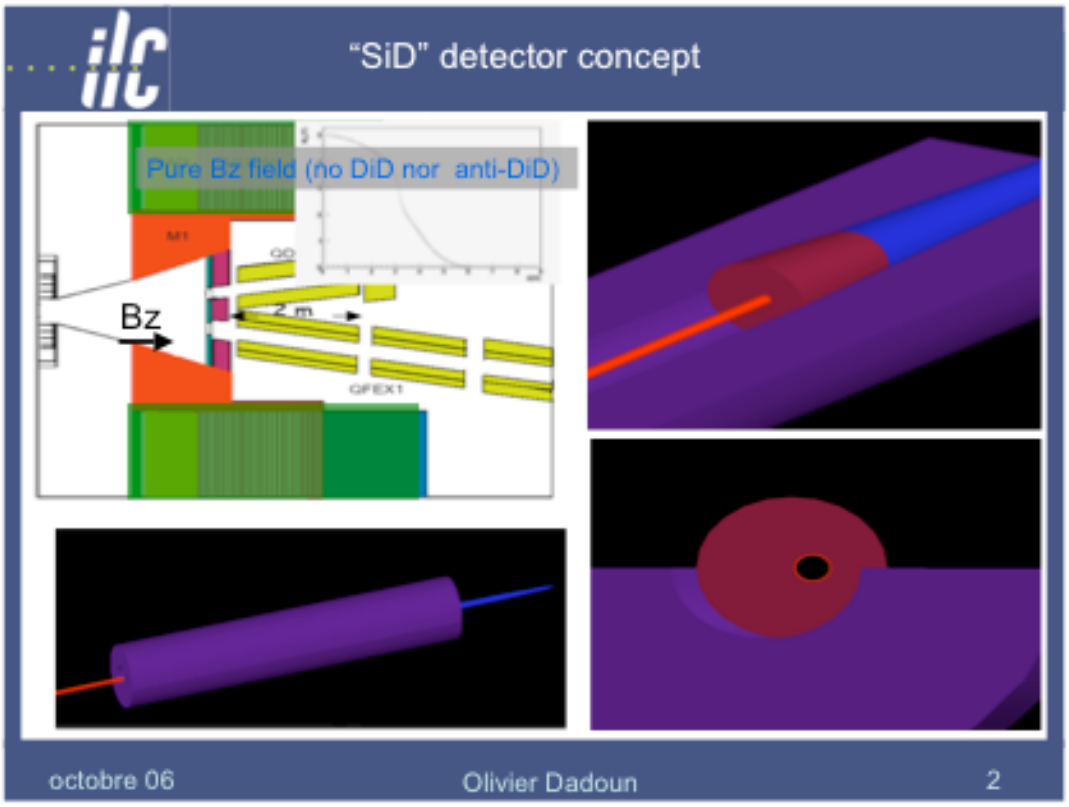
"SiD" detector concept
Pure Bz field (no DiD nor anti-DiD)
Bz
2 m
QFEX1
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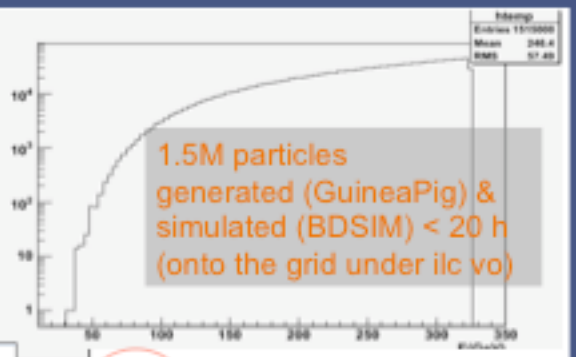
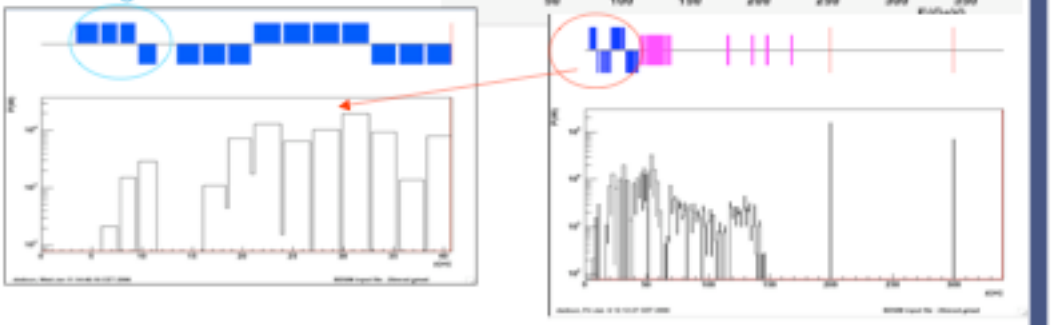
Backgrounds from beam losses in 20mrad extraction line

- To maximize the power losses and the secondaries I used the High luminosity beam parameters @ 1TeV machine with dy=80 nm beam offset (worst case not really realistic)



SC magnets



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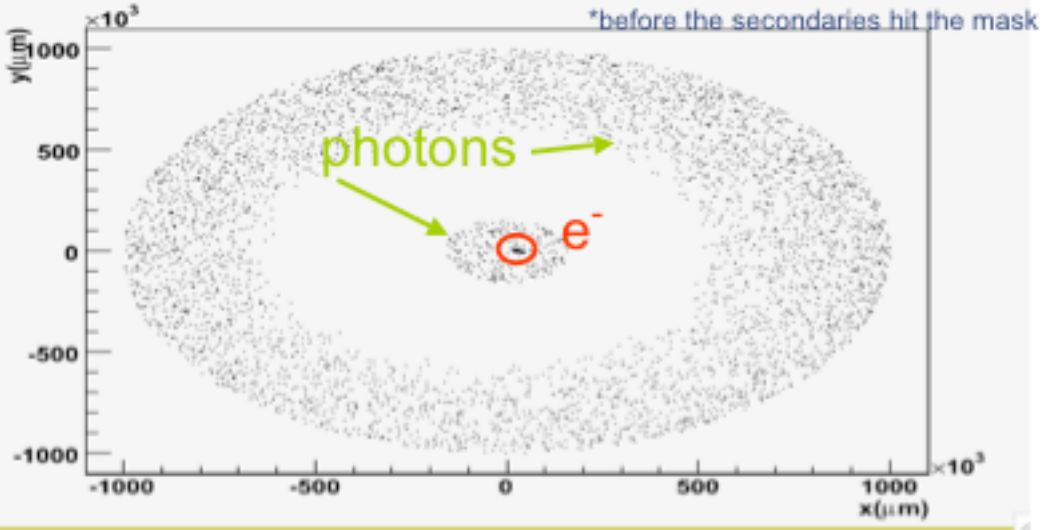
Backscattered particles @ 3.5m before* the mask



- 7602 backscattered particles:
  - 5267 photons, 2311 e^- & 24 e^+

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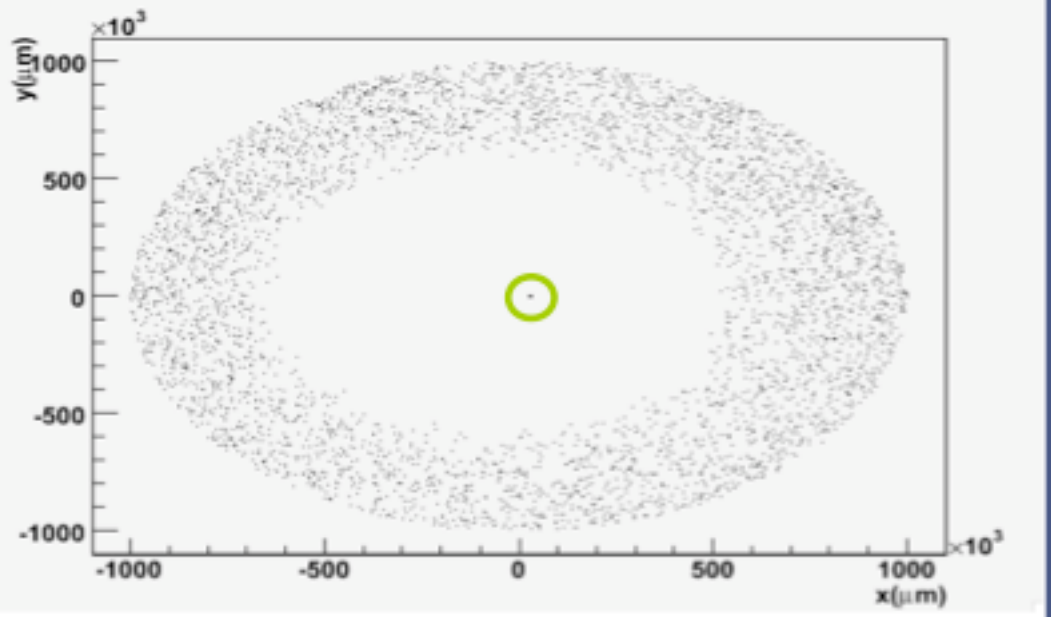
Tungsten mask stop most of the photons (center region)



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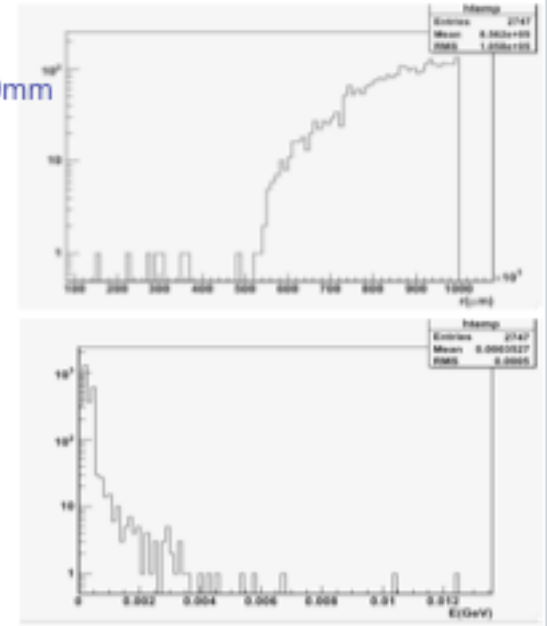
… But some of them can reach the detector

- If we consider the last layer @ 60mm
- 300 mm Si thickness
- 1% photoelectric (E~300keV)

- Backgrounds hits in VDX
  $< 1*(2*10^{10})/1.515*10^{6}*1\% = 132$

- To be compare to the 300 direct incoherent pairs hits …

- Backgrounds hits the TPC …



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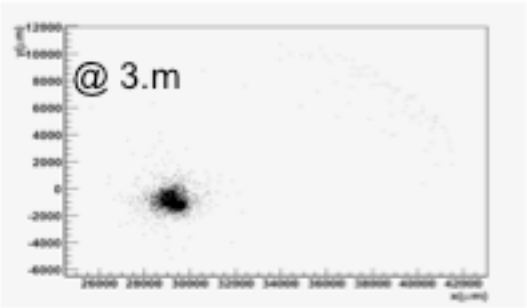
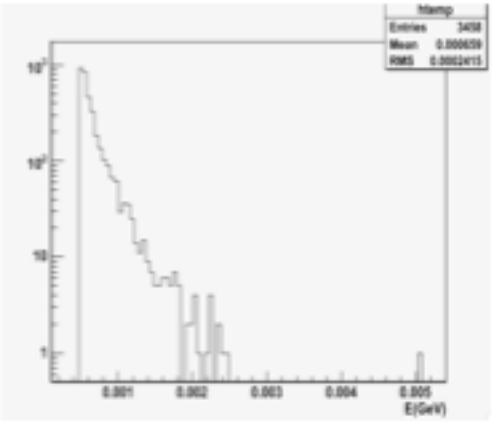
Backscattered e⁻



- 2mm of Aluminum beam pipe enough to stop 1MeV electrons
- no e⁻ can reach the VD



Conclusion and prospects

- BDSIM and GuineaPig onto Grid under ILC vo
- Backscattered e⁻ not a problem
- Backgrounds come from photons generated along the extraction line …

Future

- Take the full Mokka description
- Take into account the losses from the radiative Bhabhas
- Put the hadronic flag on

- Paper on an Abacus power in the case of the 2, 14 and 20 mrad extraction line, using different beam parameters set:

ILC extraction line Power losses Abacus
case of the 2, 14 and 20mrad crossing angle
authors: Andrei, Arnaud, Cecile, Deepa, Grahame, Ilya, John, Olivier, Philip, Rob, Yuri